

Amendment  
Application No. 10/775,075  
Attorney Docket No. 042100

**REMARKS**

Claims 1-6, 10 and 11 are pending in the application. Claim 1 is herein amended.

**Amendment Objection - 35 U.S.C. § 132 / Claim Rejections - 35 U.S.C. § 112**

The amendment to claim 1 was objected to under 35 U.S.C. § 132(a) and claims 1-6, 10 and 11 were rejected under 35 U.S.C. § 112, first paragraph, because the Office Action takes the position that amended claim 1 contains subject matter which was not described in the specification.

The Office Action acknowledges that “the projections may be intermittently spaced on the surface of the copper foil.” (Office Action, page 10; *see also* Office Action, page 2.) However, the Office Action maintains that the limitation can be broadly interpreted as a process limitation which is not supported in the specification. (Office Action, page 3.)

Claim 1 has been amended to clarify that the limitation “formed intermittently” is not a process limitation. Amended claim 1 recites that the matte side surface has “a surface shape that is smooth with intermittently spaced knob-like projections.”

In the interview with the Examiner on January 29, 2007, the Examiner acknowledged that claim 1 as amended herein would overcome the objection under 35 U.S.C. § 132 and claim rejection under 35 U.S.C. § 112, first paragraph.

Withdrawal of the Amendment objection under § 132 and claim rejection under § 112 is requested.

**Claim Rejections - 35 U.S.C. §§ 102 and 103**

**A. Patentable Weight of the Limitation: “Projections are formed intermittently”**

The Office Action takes the position that the limitation “projections are formed intermittently” is not given patentable weight since claim 1 is directed to a product. (Office Action, pages 5 and 7.) The Office Action takes the position that this limitation is a method of production limitation.

Claim 1 has been amended to clarify that the limitation “formed intermittently” is not a process limitation. Amended claim 1 recites that the matte side surface has “a surface shape that is smooth with intermittently spaced knob-like projections.”

Thus, Applicant requests that the Examiner give patentable weight to the limitation “intermittently spaced knob-like projections.”

**B. Rejections Based on Fatcheric**

Claims 1-6, 10 and 11 were rejected under 35 U.S.C. § 102(b) as being anticipated by or in the alternative, under 35 U.S.C § 103(a) as obvious over **Fatcheric** (U.S. Patent 5,679,230). Favorable reconsideration is requested.

**1. Smooth Matte Side - Surface Roughness**

Applicant respectfully submits that Fatcheric does not disclose “wherein the surface roughness thereof is 2.2 to less than 4  $\mu\text{m}$ ” as recited in claim 1.

The Office Action cites col. 3, lines 33-35 of Fatcheric for disclosing this feature. This passage states that “the matte side will preferably have a measured roughness Rz of about 4-7.5  $\mu\text{m}$  before and after such supplemental treatment.”

The roughness disclosed in Fatcheric is not within the claimed range of 2.2 to less than 4  $\mu\text{m}$ . Thus, Fatcheric does not disclose the elements as recited in claim 1.

In the Interview dated January 29, 2007, the Examiner agreed to withdrawal the § 102 rejection of claim 1 based on Fatcheric since Fatcheric does not disclose a roughness range of 2.2 to less than 4  $\mu\text{m}$ .

## **2. Intermittently Spaced Knob-like Projections**

Applicant previously pointed out that Fatcheric does not disclose “knob-like projections formed on the surface intermittently.” Specifically, Applicant stated that one of ordinary skill in the art would understand that Fatcheric does not disclose knob-like projections based on its disclosure and Fig. 2.

In response, the Office Action maintains that Fig. 2 of Fatcheric shows knob-like projections formed intermittently as broadly interpreted because the knob-like projections are spaced between the valleys and thus are not continuous. In the alternative, the Examiner states that it would have been obvious to have recognized this feature. (Office Action, page 6.)

Applicant respectfully submits that one of ordinary skill in the art would understand that Fatcheric does not disclose “a matte side surface, said matte side surface having a surface shape that is smooth with intermittently spaced knob-like projections” as recited in amended claim 1.

Fatcheric discloses that “the matte side should be relatively smooth in order to assure that the grain size and orientation are suitable for etching.” (Col. 2, lines 30-33.) Based on this statement in Fatcheric and Fig. 2 of Fatcheric, one of ordinary skill in the art would understand that Fatcheric does not disclose a matte side surface having a surface shape that is smooth with intermittently spaced knob-like projections. Therefore, Fatcheric does not disclose the elements as recited in amended claim 1, and claim 1 would not have been obvious based on Fatcheric.

### **3. Unexpected Results**

Applicant respectfully submits that the present invention provides unexpected results over the results obtained in Fatcheric, and thus, the present invention is not obvious over Fatcheric.

Table 1 of the present specification shows an untreated copper foil having a roughness of 4.74  $\mu\text{m}$ , which is within the range disclosed in Fatcheric. (Specification, page 4.) When the copper foil is treated at 300 A · min/m, the roughness is 5.14  $\mu\text{m}$ , the peel strength is 0.92 kN/m and the 3 GHz transmission loss is 3.92 dB/m.

However, Example C, a copper foil of the present invention shown in Table 8, has a surface roughness of the untreated copper foil of 2.4  $\mu\text{m}$ . (Specification, page 17.) When the copper foil is treated at 400 A · min/m and 200 A · min/m, the peel strength is 1.22 and 1.21 kN/m respectively.

The present invention demonstrates an unexpected superior peel strength compared to a copper foil as disclosed in Fatcheric. Therefore, claim 1 is non-obvious over Fatcheric.

### **C. Rejections based on Wolski**

Claims 1, 2 and 4 were rejected under 35 U.S.C. § 102(b) as being anticipated by or in the alternative, under 35 U.S.C § 103(a) as obvious over **Wolski** (U.S. Patent 5,834,140 which corresponds exactly to Japanese Patent Publication No. 3313277 disclosed on page 6, line 8 of the present specification). Favorable reconsideration is requested.

#### **1. Intermittent Knob-like Projections**

Applicant respectfully submits that one of ordinary skill in the art would understand that Wolski does not disclose “a matte side surface, said matte side surface having a surface shape that is smooth with intermittently spaced knob-like projections” as recited in amended claim 1.

Wolski discloses a copper foil having a shape of continuous mountains. (*See* col. 1, lines 11-13 and col. 5, lines 31-34.) Wolski discloses “a plating surface having less unevenness.” (Col. 5, lines 31-34.) Wolski at col. 1, lines 11-13 states: “the untreated copper foil according to the present invention has *flatter surfaces on both surfaces* as compared with conventional ones.” One of ordinary skill in the art would understand that a surface having less unevenness and which is flatter does not have knob-like projections formed intermittently on the surface. In addition, one of ordinary skill in the art would understand that the matte side of an electrodeposited copper foil, as disclosed in Wolski, has a shape of continuous mountains.

An object of the invention in Wolski is to provide a copper foil which has a high etching factor without lowering peeling resistance and accomplishing fine patterning without remaining copper particles. (Col. 4, lines 12-16.) Generally, to achieve such a copper foil, the copper foil is

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smooth and continuous, because if there are intermittent projections, residual coppers are easily generated at the points of projections, and the straight characteristic of the pattern might deteriorate.

The Office Action takes the position that the “copper nodules” deposited on the surface of the copper foil as disclosed in Wolski, corresponds with the “intermittently spaced knob-like projections.” (Office Action, page 7.) However, the copper nodules are not part of the surface of the copper foil. Amended claim 1 requires that the surface shape of the matte side has intermittently spaced knob-like projections.

Therefore, Wolski does not disclose an electrodeposited copper foil wherein the matte side surface has a surface shape that is smooth with intermittently spaced knob-like projections as recited in claim 1.

## **2. Untreated Copper Foil**

Applicant respectfully submits that Wolski does not disclose “wherein the surface roughness thereof is 2.2 to less than 4  $\mu\text{m}$ , and the copper foil is an untreated copper foil” as recited in claim 1.

The Office Action takes the position that the limitation “untreated copper foil” is not given patentable weight unless the product itself can be distinguished from the prior art. (Office Action, page 7.)

The copper nodules in Wolski, cited in the Office Action as corresponding with the intermittently spaced knob-like projections as recited in claim 1, are deposited on the copper foil to form a “treated copper foil.”

Since the untreated copper foil disclosed in Wolski does not meet the requirements as recited in claim 1, the copper foil in Wolski has different and inferior physical properties compared to the physical properties of a copper foil as recited in claim 1 of the present invention.

Comparative Example D corresponds with a copper foil as disclosed in Wolski. Example D has an untreated copper foil roughness of 0.8  $\mu\text{m}$ . After treatment at 400 A  $\cdot$  min/m and 200 A  $\cdot$  min/m, the peel strength is 0.6 and 0.59 kN/m respectively. However, under the same treatment conditions, a copper foil of the present invention as recited in claim 1 has a peel strength of 1.22 and 1.21.

The limitation “untreated copper foil” recited in claim 1 produces a copper foil having different and superior physical properties compared to Wolski, and thus provides a structural difference over Wolski. Therefore, the limitation “untreated copper foil” should be given patentable weight.

When the limitation “untreated copper foil” is properly given patentable weight, Wolski fails to meet the requirements as recited in claim 1.

#### **E. Rejection based on Wolski in view of Fatcheric**

Claims 3, 5, 6, 10 and 11 were rejected under 35 U.S.C. § 103(a) as being unpatentable over **Wolski** in view of **Fatcheric**. Favorable reconsideration is requested.

Applicant respectfully submits that claims 3, 5, 6, 10 and 11 are not obvious over *Wolski* in view of *Fatcheric* since the present invention as recited in claims 3, 5, 6, 10 and 11 provides the unexpected result of an electrodeposited copper foil having a high frequency property and high peel strength.

The electrodeposited copper foil of the present invention has high peel strength and excellent high frequency property. Neither *Fatcheric* nor *Wolski* direct attention to a high frequency property. The present invention discloses forming knob-like projections intermittently on the smooth matte side surface of the untreated foil thereby allowing for roughening treating of the untreated foil to be performed under a weak condition. Based on the experimental result that the high frequency property depends on strength of roughening treating, the present invention realizes both a high frequency property and high peel strength because only a weak roughening treatment is performed. The fact that the knob-like projection is formed intermittently is an important reason why both the high frequency property and high peel strength can be achieved in the present invention.

Note that it is not possible for a *Fatcheric*-type copper foil to realize both a high frequency property and high peel strength, as disclosed in page 5, lines 9 to 15 of the present specification. There is no description in *Fatcheric* about achieving a high frequency property. Furthermore, *Fatcheric* cannot achieve good high frequency property because the surface roughness on the matte side of the copper foil is too large, and the mountains and valleys are formed continuously.



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Note also that a *Wolski*-type copper foil needs strong roughening treatment to obtain high peel strength which brings about deterioration of the high frequency property, as written at page 6, lines 19 to 23 of the present specification. Thus, the copper foil in *Wolski* cannot achieve both a high frequency property and a high peel strength property. *Wolski* discloses that low profiling of a matte side is required for a finely patterned printed circuit board, (col. 2, lines 23-31), however there is no description about the high frequency property. The present inventor engaged in the development of the copper foil of the present invention because the copper foil of *Wolski* cannot satisfy both the high frequency property and high peel strength. (Specification, page 6, line 7 to page 7, line 2.)

Please see Table B attached to the Amendment dated August 15, 2006 which summarizes Tables 1 and 8 of the present specification. Table B indicates peel strength and transmission loss (high frequency property) of a copper foil of the present invention and copper foils according to Fatcheric and *Wolski* respectively.

The present invention as recited in claims 3, 5, 6, 10 and 11 provides the unexpected result of an electrodeposited copper foil having a high frequency property and high peel strength. Thus, claims 3, 5 and 6 are non-obvious over *Wolski* in view of Fatcheric.

Accordingly, withdrawal of the rejections of claims 1-6, 10 and 11 based on Fatcheric, *Wolski* and *Wolski* in view of Fatcheric is hereby solicited.

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In view of the aforementioned amendments and accompanying remarks, Applicant submits that the claims, as herein amended, are in condition for allowance. Applicant request such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicant's undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicant respectfully petitions for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,  
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